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Progressive Flow Control in the OTC NO_x Budget Program:
Issues to Consider at the Close of the 1999 to 2002 Period

A. Introduction

Ground-level ozone (or smog) is formed when nitrogen oxide (NO_x) and volatile organic compound (VOC) gases react with sunlight, particularly in the warm summer months. Once formed, ozone targets the respiratory system, aggravating asthma, increasing susceptibility to respiratory illnesses like pneumonia and bronchitis, and contributing to permanent lung damage. It can also damage forests, reduce the productivity of agricultural crops, and lead to the decay of monuments and buildings.

This paper examines the OTC's experience with progressive flow control as a means to manage the use of banked allowances in order to assess the performance of this mechanism, and potential issues for consideration in applying flow control in other programs.

Historically, ozone control strategies have focused on local efforts to reduce VOC emissions. Over time, however, EPA, states, and others have recognized the importance of pollutant transport from one area to another in creating ozone problems, especially long range transport of NO_x emissions from large combustion facilities. The Ozone Transport Commission (OTC) was established under the Clean Air Act Amendments of 1990 to help states in the Northeast design regional strategies to meet the National Ambient Air Quality Standard (NAAQS) for ground-level ozone.

The OTC developed an unprecedented, multi-state cap and trade program to control NO_x emissions and address regional transport of ozone. This market-based program, called the NO_x Budget Program, set a regional "budget" (or cap) on NO_x emissions from power plants and other large combustion sources during the "ozone season" (from May 1 through September 30). To meet the budget, sources were required to reduce emissions significantly below baseline levels in each participating state. States allocated allowances to sources (each allowance equaled one ton of emissions), and sources could use emissions trading to achieve the most cost-efficient reductions possible. If emissions were below budget levels, sources could "bank" unused allowances and use or trade the banked allowances to cover emissions in a subsequent ozone season.

There are many well-documented advantages associated with the ability to bank allowances, but there was also a potential concern in the case of the OTC that, as the bank grows over time, the use of banked allowances could result in a particular ozone season's emissions being significantly greater than the budget level. Thus, the OTC states created progressive flow control ("flow control") in the OTC NO_x Budget Program to discourage the overuse of banked NO_x allowances in a particular ozone season that could lead to increased emissions during ozone episodes and raise concerns regarding seasonal air quality. Once the total regional bank reached a certain size (10 percent of the regional

budget), the flow control provisions allowed a source to use only some of its banked allowances for compliance without penalty. The remaining banked allowances had to be surrendered on a 2:1 basis (two allowances for each ton of emissions).

As part of a NO_x SIP Call promulgated in 1998, EPA developed a NO_x Budget Trading Program that encompasses most of the OTC states and eleven additional U.S. states. This regional trading program is similar to the OTC program, and also uses flow control to discourage overuse of banked allowances. The NO_x Budget Trading Program under the SIP Call began in May, 2003, for OTC states, and begins for the other states in May, 2004, at which time sources will have to meet the ozone season NO_x budget. Flow control under this program starts in 2005, if triggered (e.g., if banked allowances exceed 10 percent of the region-wide seasonal budget).

Some market participants and other stakeholders have raised concerns that flow control is overly complex and unnecessary. In this paper, EPA looks at the OTC experience from 1999 through 2002 to provide insight into the performance of flow control and to identify possible issues for evaluating the use of flow control under the NO_x Budget Trading Program. To put this analysis into perspective, this paper provides a brief overview of the OTC program and the transition to the NO_x SIP Call, as well as additional background on banking and the flow control concept.

B. Background on the OTC NO_x Budget Program and NO_x SIP Call

The OTC NO_x Budget Program began on May 1, 1999, with the objective of reducing NO_x emissions in the northeastern U.S. to attain the NAAQS for ground-level ozone. The NO_x Budget Program allowed inter-facility emissions trading to facilitate cost-effective compliance with a fixed cap on ozone-season NO_x emissions. Under this program, an affected budget source had several compliance options, including post-combustion add-on controls and trading. If a budget source used trading as a compliance option, there were three primary results:

Participating OTC NO_x Budget Program states included CT, DE, MA, MD, NH, NJ, NY, PA, RI, and the District of Columbia.

- Emit at a level commensurate with the unit's allocation,
- Emit less than the allocation and either bank or sell the surplus allowances, or
- Emit more than the allocation and purchase additional allowances to cover the difference.

With the exception of banked allowances retired for compliance, the region-wide emissions budget could not be exceeded during the control period; this ensured that the environmental objectives of the program would be achieved. The reductions demanded by the budget, which relied on a combination of combustion and post-combustion controls, would have been substantially more burdensome for affected sources in the absence of the accompanying trading program.

While the OTC's multi-state approach to NO_x reductions provided some flexibility for participating states, the uniformity of certain program elements across the state regulations ensured that the region-wide reductions occurred in a consistent, enforceable manner. This uniformity facilitated the development of markets for NO_x allowances with active trading among participants.

C. Allowance Banking and Flow Control

Generally, EPA believes that allowing sources to bank unused allowances:

- Encourages earlier or greater reductions than are required from sources, providing human health and environmental benefits,
- Stimulates and encourages efficient use of the market, and
- Provides flexibility in achieving emission reduction goals.

This flexibility allows sources periodically to increase fossil fuel combustion activity levels. A key concern in this regard are extended periods of interruptions in power supply from nuclear power plants (which, as non-NO_x emitting sources, were not in the OTC program).

Despite the benefits of banking, above, others perceive this flexibility from banking as a concern because, in a given ozone season, a large bank could interfere with the environmental goal of limiting ozone season NO_x emissions to the regional emissions budget level. The budget is set at a level to reduce the potential for regional NO_x transport from upwind areas to contribute significantly to episodes of ozone non-attainment in downwind areas. If the bank expands over time, sources could use a large portion of the bank in a single ozone season and significantly exceed the budget. This concern is heightened by the perception that sources will have the greatest need to use banked allowances in years with hot summer conditions where both electricity demand is high and ozone conditions are often at their worst.

The flow control provisions were designed to discourage extensive use of banked allowances in a particular ozone season. (See accompanying text box for example of how flow control works.) Flow control establishes a 2:1 discount ratio on the use of banked allowances above a certain level. The discount ratio applies after the total number of banked allowances from all sources exceeds 10 percent of the region-wide NO_x emissions budget. The OTC states chose the 10 percent level based on an analysis of the amount of additional fossil fuel electricity generation that might be needed in an ozone season to make up for temporarily reduced levels of nuclear generation.

The program administrator (EPA) tabulates the total banked allowances following completion of the compliance process for a given ozone season. If flow control is triggered, the applicable flow control discount ratio applies prospectively to banked allowances used for compliance in the next ozone season. It is important to note that the

discount ratio only applies to allowances when a source uses them for compliance purposes. Allowances sold or traded on the allowance market are never subject to flow control.

An Example of How Flow Control Works

- Assume a total regional trading program budget of 300,000 allowances.
- Assume after year 1, sources have banked 35,000 allowances.
- Since the bank is more than 10 percent of total budget ($35,000/300,000 = 11.7$ percent), a flow control ratio will apply in year 2 when banked allowances are used for compliance.
- The flow control ratio would be 0.86 (determined by dividing 10 percent of the total trading program budget by the total number of banked allowances, or $30,000/35,000$).
- The flow control ratio is applied to banked allowances in each source's allowance accounts at the time of compliance reconciliation. If a source holds 1,000 banked allowances at the end of year 2, it will be able to use 860 of them on a 1-for-1 basis, but will have to use the remaining 140, if necessary, on a 2-for-1 basis for compliance.
- So, if the source used all of the banked allowances for year 2 compliance, the 1,000 banked allowances could be used to cover only 930 tons of NO_x emissions ($860 + 140/2$).

When EPA proposed the NO_x SIP Call trading program in 1997, it examined other options for managing banked allowances, such as:

- Placing a limit on the number of allowances a source could bank, or
- Using a source-by-source (instead of region-wide) approach to flow control, whereby each source's number of allowances would determine that source's ratio.

EPA chose to continue the OTC approach to flow control because the regionally-based flow control provisions were deemed to provide a desirable safeguard while maintaining the benefits associated with banking (i.e., incentive to over-comply, flexibility to sources, and stimulation of the market). Sources had significant lead time to consider how the flow control ratio affected their compliance planning for the upcoming ozone season. Also, by using the same basic approach as the OTC, EPA minimized the disruption to OTC sources transitioning to the SIP Call program.

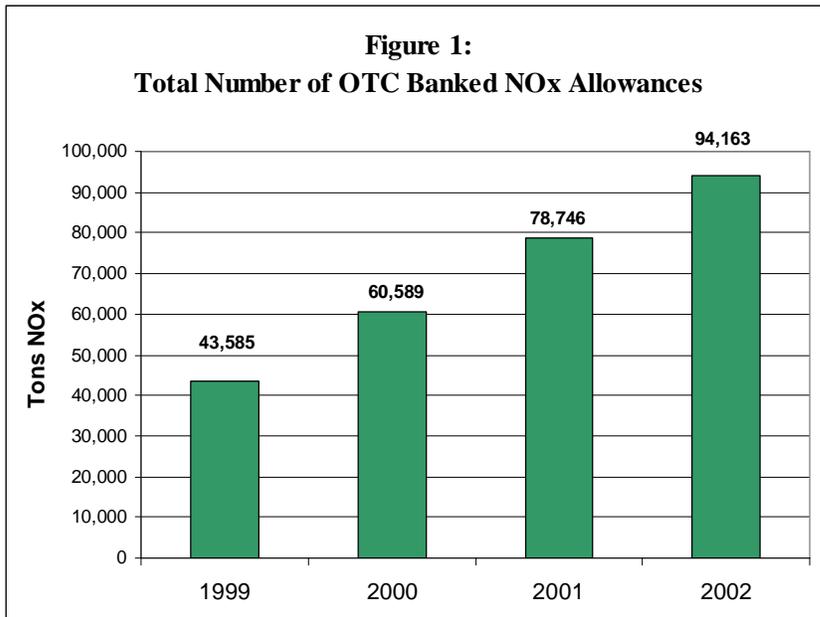
EPA determined that the flow control provisions, while retaining flexibility, would support the goal of achieving attainment in downwind non-attainment areas by

discouraging (but not barring) excessive use of banked allowances in any given control period. The discount ratio, when triggered, also provides an added benefit for the environment by removing two allowances for every one ton of NO_x emitted. That extra allowance deducted from the system represents one less ton of future NO_x emissions.

D. The OTC Experience With Flow Control from 2000 through 2002

1. Growth in OTC Banked Allowances

The period from 1999 to 2002 saw a steady growth in the size of the OTC allowance bank, and flow control applied for each season after 1999. Figure 1 shows the growth in the number of banked NO_x allowances throughout the OTC NO_x Budget Program. The large initial bank of allowances after the 1999 compliance season reflects early reduction credits allocated in 1999. The early reduction credits were given for real, quantifiable, and surplus emission reductions achieved by budget sources in the 1997 and 1998 ozone seasons. These credits were additional to the budget, increasing 1999 allowances available. However, the continued increase in the bank after 1999 shows that sources continued to emit well below regional budget levels throughout the period. As a



result of this growth in banked allowances, the flow control discount ratio fell sharply during the 2000 to 2002 period. In 2000, sources could use 50 percent of their banked allowances on a 1:1 basis. By 2001, they could use only 36 percent on a 1:1 basis, and by 2002, that figure had dropped to 27 percent.

Source: OTC Compliance Reports.

By the end of 2002, the total number of banked allowances had reached over 40 percent of the total annual budget level. The fact that total regional emissions remained below the seasonal budget even with so many banked allowances available is consistent with the OTC's goal for establishing the flow control provisions. However, there are too many other factors, including the phased nature of the OTC program and the transition to the NO_x Budget Trading Program, to suggest that flow control affected sources' compliance and banking decisions during this period.

2. Transition of OTC Banked Allowances to the NO_x Budget Trading Program is Important to Flow Control Analysis

One of the key issues for the OTC in making the transition to the NO_x Budget Trading Program was the treatment of OTC banked allowances. As part of the transition, all OTC allowances were retired so that the new program would begin with a clean slate. However, EPA provided a "compliance supplement pool" (CSP) of allowances as part of the NO_x SIP Call. In the affected OTC states, the total number of CSP allowances was about 25,000. In 2005, the first season when flow control is likely to be triggered under the NO_x Budget Trading Program, EPA will consider these CSP allowances, and any remaining 2003 and 2004 vintage year allowances, as "banked" for purposes of applying flow control.

The intent of the CSP allowances was to provide a means for states to reward early reductions, or to provide for hardship situations. Because the banked OTC allowances essentially reflected early reductions in the context of the OTC program, most OTC states established a process to provide CSP allowances in a pro rata exchange for banked OTC allowances held at the end of the OTC program by sources in their jurisdictions. There were a few exceptions to this approach that are important in evaluating the OTC's experience with the flow control provisions:

- None of the states considered 1999 vintage year allowances in determining the pro rata distribution of CSP allowances.
- Pennsylvania also excluded 2000 vintage year allowances in determining distribution of CSP allowances.
- Maryland, which did not fully enter the OTC program until 2002, distributed CSP allowances on the basis of early reductions achieved using a specific emissions-based formula instead of using the banked OTC allowances as a surrogate.

These exceptions meant that the 1999 allowances, as well as the 2000 vintage year allowances held in Pennsylvania source accounts and all banked allowances held in Maryland source accounts, were retired and could not be used for future compliance at the completion of the OTC program. In essence, these allowances became "use or lose" allowances, and this factor played a significant role in the application of progressive flow control from 2000 to 2002, as the following section discusses.

3. Analysis of OTC NO_x Allowances Surrendered on a 2:1 Basis

In each ozone season from 1999 to 2002, OTC sources emitted significantly below the regional budget level. Even with an overall surplus of allowances each season, many sources surrendered banked allowances for compliance. Some of these sources

Allowances Surrendered on 2:1 Basis

2000: 1,822	2002: 14,809
2001: 9,874	Total: 26,505

even decided to surrender banked allowances on a 2:1 basis under the flow control provisions. The volume of allowances surrendered on a 2:1 basis grew each year that flow control was in effect - from less than 2,000 allowances in 2000 to nearly 15,000 allowances in 2002. In addition, the participation of facilities in 2:1 transactions was reasonably widespread, with about 90 out of approximately 350 facilities with affected budget sources surrendering allowances on a 2:1 basis.

Because regional emissions were below the number of allocated allowances each year, the decision to use allowances on a 2:1 basis subject to flow control cannot be explained solely by a need to draw down the bank in response to a high level of emissions. The surrender of allowances at a 2:1 basis under flow control imposed a penalty on the affected sources that was not directly linked to the environmental purpose for flow control. Given the significant number of allowances surrendered on a 2:1 basis (about 26,000 allowances), this disconnect between the reasons for flow control and the practical implementation of these provisions bears further analysis.

This section examines these transactions in detail. Generally, sources appeared to make economic decisions, in about 90 percent of the cases where allowances were surrendered on a 2:1 basis, in light of the transition to the NO_x Budget Trading Program, and not in response to the constraint on banked allowances. These transactions do not suggest that flow control caused significant problems but rather that the program transition created an impetus to use up these allowances. However, the remaining 2:1 transactions appear to be caused by other factors, such as administrative convenience, or market experience and access issues. These factors are discussed below.

a. Transition to the NO_x Budget Trading Program as Reason for Surrendering Allowances on a 2:1 Basis

As noted above in Section D.2., not all OTC banked allowances would be considered as part of the OTC states' distribution of allowances under the compliance supplement pool (CSP). These banked allowances became "use or lose" allowances, and the vast majority of the allowances surrendered on a 2:1 basis fell into this unique category of allowances. The following discussion highlights these "use or lose" allowances.

1999 Vintage Year Allowances

Sources were aware that 1999 vintage year allowances would not be included in calculating distributions of CSP allowances, and that states would retire these allowances permanently at the end of the 2002 NO_x season. Of the roughly 26,500 allowances deducted on a 2:1 basis, over 13,300 were vintage year 1999 allowances. As Table 1 shows, nearly as many 1999 allowances were taken 2:1 as 1:1 in 2002. Fewer than 600 allowances from the 1999 vintage year remained in source accounts after deducting allowances for 2002 compliance.

**Table 1:
 1999 Vintage Year Allowances Deducted per Year**

Deduction Type	1999	2000	2001	2002	2003
2 for 1 Basis		1,822	4,571	6,953	
1 for 1 Basis	171,779	11,351	11,182	6,138	
Retired					566

Source: NO_x Allowance Tracking System (NATS) data.

2000 Vintage Year Allowances Held by Pennsylvania Sources

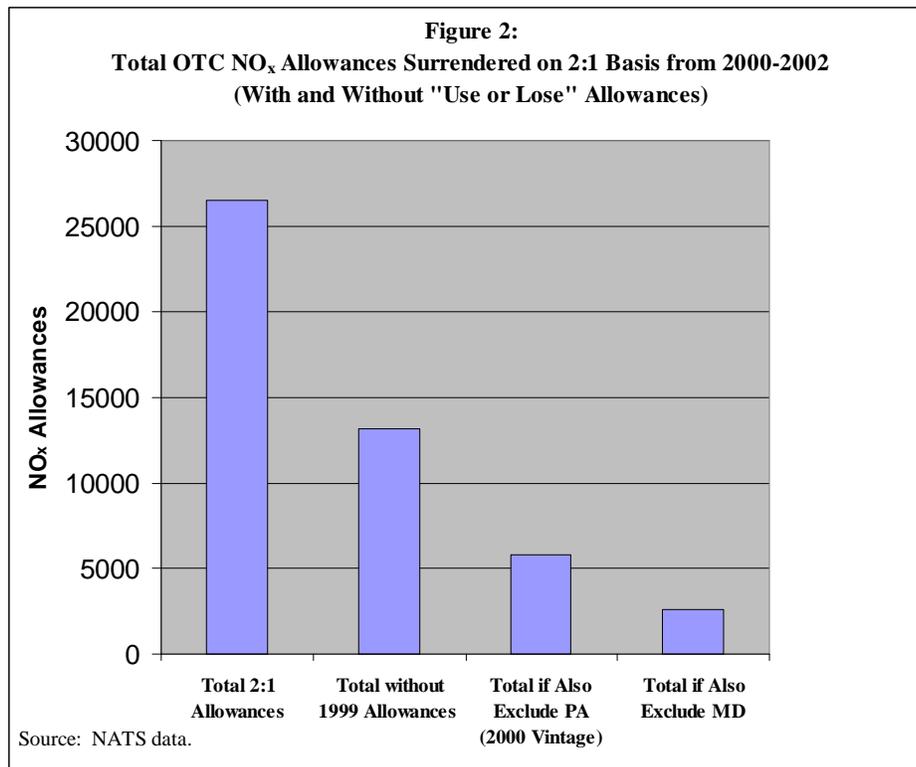
As with the 1999 vintage year allowances, Pennsylvania did not consider 2000 vintage year allowances held by its sources when distributing CSP allowances. The Pennsylvania sources had two options for 2000 vintage year banked allowances: transfer them to sources in states which did consider 2000 vintage year allowances in distributing CSP allowances, or use them before the end of 2002. Of the 26,500 allowances deducted on a 2:1 basis, there were 13,200 allowances deducted that were not vintage year 1999 allowances. Of these 13,200 allowances, 7,400 allowances were 2000 vintage year allowances surrendered by Pennsylvania sources.

Banked Allowances Held by Maryland Sources

Maryland did not distribute CSP allowances on the basis of OTC banked allowances. As a result, Maryland sources had two options for using their banked allowances: use them for compliance through 2002, or transfer them to sources in states which did consider banked allowances in distributing CSP allowances. Of the 26,500 allowances deducted on a 2:1 basis, there were 5,800 allowances deducted that were not vintage year 1999 allowances or vintage year 2000 allowances surrendered by Pennsylvania sources. Of these 5,800 allowances, about 3,200 allowances involved Maryland plants.

Remaining Banked Allowances

After taking into account the "use or lose" nature of many of these banked allowances, only about 2,600 of approximately 26,500 allowances used on a 2:1 basis involved allowances that would have had market value in determining a source's share of compliance supplement pool allowances. (See Figure 2 for a breakdown of these transactions.) While over 90 OTC-affected facilities surrendered some allowances on a 2:1 basis, only about 30 OTC-affected facilities (about 10 percent) surrendered banked allowances at the required 2:1 rate that were not "use or lose" allowances.



b. Other Reasons That May Explain Decisions to Surrender Allowances on a 2:1 Basis

The transition to the NO_x Budget Trading Program does not explain all of the transactions that included surrendering allowances on a 2:1 basis. For the roughly 2,600 allowances that sources opted to surrender on a 2:1 basis (even though current year allowances, theoretically, were available through the marketplace), some other factors influenced sources' decisions. Three factors that may have played some role in these decisions are:

- Allowance price differential,
- Administrative convenience, and
- Market experience and access.

It is important to note that these factors are unrelated to the reasons for establishing flow control. Even though emissions were below the regional budget, the sources that made these transactions bore the burden of the flow control restrictions. These results suggest that the practical effect of flow control can be somewhat arbitrary. At the same time, the 2,600 allowances used on a 2:1 basis represent less than 0.5 percent of all allowances surrendered for compliance from 2000 through 2002, so the overall impact of flow control on the affected sources was minor throughout this period.

Allowance Price Differential

Generally, the market did factor in a reduced price for banked allowances (see Farrell, 2002; Williamson, 2002). This reduced price is expected with the use of flow control, which makes some portion of the overall allowance bank less

valuable, given that each of the allowances subject to flow control is worth only one half ton of NO_x emissions. A source with two banked allowances that were trading for \$150-\$250 less than a current year allowance should have been able to enter the allowance market and thereby avoid the surrender of allowances on a 2:1 basis. For instance, if current year allowances were trading at \$1,000 and a source needed one more 1:1 allowance in its compliance account to cover its emissions, a source could purchase that current year allowance for compliance, while selling the two banked allowances in its account for \$750-\$850 each. In this example, the source is in the same position in terms of its allowance holdings after deductions for compliance, but the source has made \$500-\$700 by using the allowance market as part of its compliance strategy. The fact that sources opted to spend two allowances for compliance when they may have had to spend something less than that amount points to other market issues at play in making these 2:1 decisions.

From 2000 through 2002, banked allowances sold for about \$150-\$250 (on average) less than current year allowances.

Source: Natsource LLC; Cantor Environmental Brokerage

Administrative Convenience

For sources that need to use banked allowances on a 2:1 basis for only a small amount of emissions, the transaction costs of looking for a cheaper option to cover their emissions could have outweighed their potential savings. These transaction costs could explain many of the decisions to use allowances on a 2:1 basis. For example, if the analysis excludes the transactions that involve only "use or lose" allowances, there remain 55 transactions that include 2:1 banked allowances. The median size of these transactions was only 6 allowances, and 30 out of the 55 transactions involved less than 10 allowances surrendered on a 2:1 basis. These results suggest that administrative convenience and transaction costs may have played a large role in many sources' decisions to use allowances on a 2:1 basis.

Market Experience and Access

The OTC NO_x Budget Program included both electric generating units (EGUs) and industrial, or non-electric generating, units. The EGUs generally were accustomed to the trading concept as part of the Acid Rain Program, and most of the EGU facilities are owned or operated by

See EPA's separate paper on "Industrial Source Participation in the OTC NO_x Budget Program" for further information on this sector.

companies that have a number of affected plant. In contrast, the industrial sources do not participate in the Acid Rain Program, and most of the owners have only one plant affected under the OTC NO_x Budget Program.

Because of these differences, some have suggested that the industrial sources may be disadvantaged in the marketplace, especially if a market has liquidity problems. In a fully liquid market, sources that need to obtain allowances can do so at the prevailing market price and with reasonable transaction costs. In an illiquid market, participants that have less experience and access may be disadvantaged and unable to transfer and obtain allowances at prevailing market conditions.

One signal of a liquidity or market access concern would be that industrial source owners tend to be more likely to use 2:1 banked allowances, not because overall emissions are above budget levels, but because they find it too difficult to access the market to obtain other allowances. A review of the allowances transferred on a 2:1 basis indicates that there is some evidence that the industrial sources did face this type of difficulty.

<u>Summary of Industrial Sector 2:1 Transactions</u> (2000-2002)	
Number of Operating Industrial Plants:	39
Number of Industrial Plants with 2:1 Transactions:	7
Median Size of Transaction:	36
Total Number of 2:1 Allowances:	620
Source: NATS data.	
Note: Summary data excludes "use or lose" banked allowances.	

As a group, the industrial sources represented nearly 6 percent of the seasonal emissions in the OTC NO_x Budget Program. However, out of the roughly 2,600 allowances surrendered on a 2:1 basis that were not "use or lose" allowances, about 25 percent of the

allowances involved industrial sources (620 total). This disproportionate use of 2:1 banked allowances by the industrial sector may indicate a potential issue. However, the results may reflect individual plant decisions and circumstances rather than a significant trend for the overall industrial sector.

E. Concerns with Flow Control and Lessons Learned from the OTC Experience

As noted above in Section D, the flow control provisions were in effect from 2000 to 2002. During this period, even though there was a large allowance bank, emissions remained below the regional budget in each ozone season. These results are consistent with the intention of the flow control provisions, and may allay some concerns that including flow control would discourage sources from reducing emissions beyond required levels.

However, there remain concerns with the application of flow control in a cap and trade program. First, there are administrative burdens for the regulatory agencies, both

initially to establish implementation procedures and systems, and on a continuing basis to ensure that the regulated sources apply flow control correctly. More importantly, flow control may have adverse market impacts and may not provide environmental benefits. This section analyzes three main concerns with market impacts and benefits, and provides insights relative to the OTC experience.

1. Flow control can create market pricing complexity and uncertainty.

Although the 2:1 discount ratio is constant and the next year's flow control ratio is known after each year's compliance determination (or allowance account "reconciliation"), flow control still adds to pricing complexity. This is because the value of banked allowances beyond the next season is uncertain. Changes in the percentage of allowances affected by the 2:1 flow control provisions will change the need for, and future value of, all banked allowances. In addition, although a straightforward formula is used to determine the discount factor, it is based on aggregate behavior of all firms that hold allowances, so individual firms do not know what, if any, discount will be applied to their allowances until after they have made decisions about banking. These complicating factors will remain under the flow control provisions of the SIP Call's NO_x Budget Trading Program.

Analysts have described a reluctance to rely on the NO_x allowance market in the early years of the OTC program. Other papers (see, for example, Farrell, 2003) note that several factors contribute to a problem of perception about the market mechanisms, and that generally most firms thought of the OTC NO_x Budget Program solely as a regulatory compliance issue, not a potential economic opportunity through the allowance market. The added complexity of flow control contributes to the barriers to using creative, market driven strategies as part of a source's overall compliance plan.

However, the market did develop a discount factor for banked allowances (as noted above, banked allowances sold for about \$150-\$250 (on average) less than current year allowances from 2000-2002). This trading behavior shows that market participants did attempt to account for flow control influences on allowance pricing and valuation. Additional factors also complicated allowance pricing during this period:

- The transition to the SIP Call, and the pro rata distribution of 25,000 compliance supplement pool (CSP) allowances in place of retired OTC banked allowances, including the difference in treatment of banked allowances in different states.
- Delayed entry into the program by Maryland and the District of Columbia.

Both of these factors likely contributed to market uncertainty and complexity. EPA will continue to analyze the potential for flow control to cause pricing complexity as part of implementing the NO_x Budget Trading Program, where these other complicating factors will not be present.

2. Flow control can have a bigger impact on small entities than on large entities.

Brokers tend to believe that, as a general rule, flow control provides more incentives for sources to be proactive with their surplus. Banking without any restrictions on the use of banked allowances (e.g., “free” banking provisions under EPA's Acid Rain Program) does not provide such a sense of urgency to act on or use a surplus. However, brokers also have indicated that, in their experience, it tends to be only the more experienced sources which understand the concept of flow control and manage their assets around it. They may, for example, “play the spread” between current and future years. They also have the ability to shift banked allowances among multiple plants they operate to minimize the number surrendered on a 2:1 basis.

In contrast, operators with a small stake in the trading program, including most of the industrial source owners that operate only a single affected plant, cannot use multiple plants to manage their flow control limitations. Some market participants believe these sources generally stay out of the market due to these complexities and instead use their allowances only as a compliance tool to be surrendered at the end of an ozone season. Thus, these smaller entities may surrender banked allowances on a 2:1 basis, less because of the environmental reason for flow control (regional emissions being significantly greater than budget levels in the aggregate), and more because of market conditions that make it difficult for them to access current year allowances that could be surrendered on a 1:1 basis.

The results during the 2000 to 2002 time period provide some indication that the industrial sources in the OTC NO_x Budget Program did surrender allowances on a 2:1 basis at a higher percentage than their total budget share would suggest (see the discussion in Section D.3, above). However, overall 2:1 allowance transactions affected only 7 out of 39 operating industrial plants, and only two of those plants had more than 100 allowances surrendered on a 2:1 basis. Of those two plants, one engaged in multiple private transactions and was a net seller of allowances. The plant transferred current year allowances in 2002 to a separate entity while surrendering banked allowances in 2002 on a 2:1 basis. This behavior suggests market awareness and market-based decisionmaking.

Overall, the extent of 2:1 allowance surrender, although somewhat disproportionately weighted toward industrial sources, was small. The results appear to reflect individual decisions at particular facilities, as opposed to clear trends within groups of affected sources. EPA will continue to look at these market behaviors and the incorporation of the industrial sector as it assesses the behavior of different types of sources in the NO_x Budget Trading Program.

3. Flow control does not directly effect short-term emissions, so it may not serve the environmental goals of the program.

Some analysts and stakeholders oppose flow control because it is not linked directly with the short-term ozone episodes that it seeks to avoid (see, for example, Farrell, 2003).

EPA's ozone NAAQS is a short-term standard (currently an 8-hour standard), and so daily peak emission spikes are of concern. Flow control does not directly influence those spikes. External factors, such as meteorological conditions, have the most influence on what emissions are on a particular day. On days when the temperature is 100°F, it is likely that a power plant will be running at peak levels to meet demand, regardless of the emissions impact. The overarching flow control ratio does not directly place limits on this activity, although it may indirectly affect peak emissions.

Neither the seasonal NO_x budget nor the flow control provisions directly limit or cap short-term or daily emissions. Instead, the regional budget acts to lower mass emissions over a season. However, this seasonal reduction impacts daily emissions, both average and peak daily emissions. Most of the reductions come from controls on coal-fired, baseloaded units. By reducing the emissions from these units, the daily emission levels, both in terms of average and peak daily emissions, will come down from baseline levels. Based on an analysis of daily emissions data available for Acid Rain Program units in the OTC program, the average daily emissions were down about 30 percent in 2002 from the average in the 1997 to 1998 period. The 2002 peak daily emissions from these units were also down nearly 30 percent from the same period, and were almost as low as the average daily emissions in the 1997 and 1998 ozone seasons.

Thus, while the flow control provisions do not directly limit peak daily emissions, they are consistent with the seasonal budget approach. They discourage sources from over reliance on banked allowances as the regional bank becomes large. If sources were able to increase the regional emissions significantly by overusing banked allowances in a particular ozone season, the short-term, daily emissions (both average and peak emissions) would also increase. To the extent that short-term emissions in a particular local area remain a concern, states can consider targeted controls on particular plants to limit their short-term emissions, if needed, in addition to the significant background reductions from a regional budget trading program.

F. Conclusion

The overall results of flow control in the OTC NO_x Budget Program indicate that the provision had little impact on emission levels, but also had little impact on the sources in the program or the functioning of the allowance market. Although flow control complicates pricing of allowances, allowance banking and trading volumes remained high throughout the period, relative to the number of allowances under the cap, and the market did establish price differentials for allowances based on vintage years. Several brokers EPA talked to described the OTC NO_x Budget Program market as “active” and “vibrant” with “great liquidity.” Thus, the market seemed able to absorb the complexity created by the use of flow control. In addition, the decision to use allowances on a 2:1 basis under the flow control provisions generally was based on the “use or lose” nature of many of the banked OTC allowances under the transition to the SIP Call NO_x Budget Trading Program. These results also point out that sources were actively managing their use of allowances.

In the limited number of transactions where sources surrendered other banked allowances (not characterized as "use or lose") on a 2:1 basis, there are likely a number of factors that can explain these transactions, but these reasons do not appear to relate to the environmental reasons for establishing flow control. For instance, many of these transactions involved a small number of allowances that suggests that the 2:1 surrender occurred for administrative convenience (as opposed to trying to obtain other allowances from the market that could be used on a 1:1 basis), especially given the discounted price for banked allowances versus current year allowances. Also, market liquidity issues and market experience may have played a role for some sources. Given the number of allowances surrendered on a 2:1 basis by the industrial sector versus the overall market share of these plants, the data show that owners of industrial plants engaged in a disproportionate share of these transactions compared to owners of EGU plants. However, the relatively small number of industrial plants and allowances involved suggests that the impact of these market concerns was limited.

Further qualitative research, based on discussions with sources and other market players, might add insight on sources' reasons for banking allowances, using 2:1 transactions in the face of apparent availability of current year allowances in the market, and other aspects of flow control implementation. In addition, quantitative studies on operational parameters, such as the cost of reducing use of a facility's add-on control system versus the value of banked allowances surrendered, could reveal any economic incentives for using, or avoiding the use of, banked allowances subject to flow control. EPA will continue to examine these issues as states and sources implement the broader SIP Call NO_x Budget Trading Program in 19 states and the District of Columbia, including the potential use of flow control beginning in 2005.

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